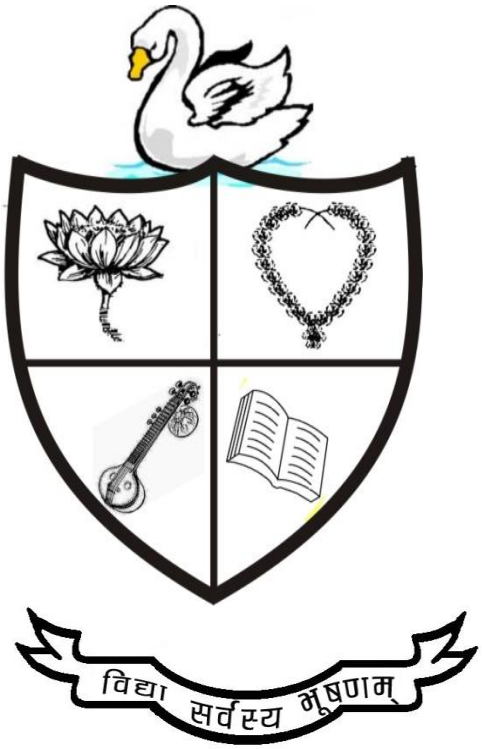
GOVT. DIGVIJAY P.G. AUTONOMOUS COLLEGE
RAJNANDGAON (C.G.)

DEPARTMENT OF ZOOLOGY



M.Sc. Zoology Semester Exam (I – IV)

Syllabus

(2025 – 2026)

(Approved by Board of Studies)
Effective from July 2025-26

Syllabus based on Credit Based System

At post-graduate level, candidates are required to study 16 Paper in Ist, IInd, IIIrd and IVt^{h} semester examination (16 - Papers in each semester). There will be sixteen papers in each post-graduate examination in Zoology, containing 80 credits. In Ist, IInd, IIIrd and IVth semester, each paper carry 100 marks (80 marks for external examination and 20 marks for internal examination). The semester includes two practical, each practical contains 100 marks. There will be 2400 marks in M.Sc. Candidates will have to secure 36 percent marks in aggregate of all papers in order to pass the M.Sc. Examination. Semester IV has two optional Subjects, Elective A & Elective B, out of which student has to choose one option.

New Syllabus: Semester I & II (As Per NEP 2020)

Semester	Title of Paper	Credits
Ist SEMESTER	I. Biosystematics and Taxonomy	4
	II. Biotechnology & Genetic Engineering	4
	III. Immunology	4
	IV. Parasitology	4
	Lab Course I - Based on Paper I & II	2
	Lab Course II - Based on Paper III & IV	2
		20
IInd SEMESTER	I. Molecular Biology	4
	II. Biotechniques	4
	III. Developmental Biology	4
	IV. Basics of Computer & Biostatistics	4
	Practical I- Based on Paper I & II	2
	Practical II- Based on Paper III & IV	2
		20

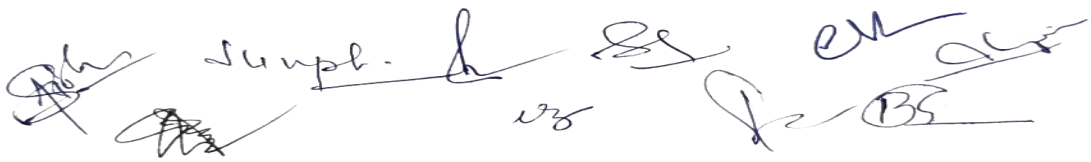
Old Syllabus: Semester III & IV

IIIrd SEMESTER	I. Population Genetics and Evolution	4
	II. Animal Behavior	4
	III. Gamete and Developmental Biology	4
	IV. Comparative Physiology of Vertebrates	4
	Practical I- Based on Paper I & II	2
	Practical II- Based on Paper III & IV	2
		20
IVth SEMESTER	**Elective A :**	
	I. Biochemistry(Compulsory)	4
	II. Limnology(Compulsory)	4
	III. Ichthyology(Optional)	4
	IV. Pisiculture and Fishery Economics (Optional)	4
	Practical I- Based on Paper I & II	2
	Practical II- Based on Paper III & IV	2
		20
IVth SEMESTER	**Elective B:**	
	I. Biochemistry(Compulsory)	4
	II. Neurophysiology(Compulsory)	4
	III. Entomology(Optional)	4
	IV. Applied Entomology(Optional)	4
	Practical I- Based on Paper I & II	2
	Practical II- Based on Paper III & IV	2
	Total Credits	**80**

GOVT. DIGVIJAY COLLEGE RAJNANDGAON (C.G.)
Department of Zoology
Syllabus of Semester System
Scheme of Semester Examination
(2025 – 26)

1. The Degree shell be called M.Sc. (Zoology)
2. The course is based on semester system having two semesters in each year.
3. Each semester will have 4 theory papers of 100 marks, distributed in to 80 marks for theory and 20 marks for internal assessment. (average marks should be given from internal test 20 marks + seminar 20 marks + attendance 20 marks + project 20 marks)
4. Semester IV has two optional Subjects, Elective A & Elective B, out of which student has choose to option one.
   Elective A: Ichthyology and Pisiculture.
   Elective B: Entomology & Applied Entomology.
5. There will be two practical related with course of 100 marks.

Sem.	Theory Paper	Marks Theory + Internal Assess. 80+20=100	Lab Course
Sem. I	I. Biosystematics and Taxonomy II. Biotechnology & Genetic Engineering	100 100	Lab Course I-100
	III. Immunology IV. Parasitology	100 100	Lab Course II-100
Sem. II	I. Molecular Biology II. Biotechniques	100 100	Lab Course I-100
	III. Developmental Biology IV. Basics of Computer & Biostatistics	100 100	Lab Course II-100
Sem. III	I. Animal behavior II. Population genetics and Evolution	100 100	Lab Course I-100
	III. Gamete and developmental Biology IV. Comparative physiology of Vertebrates	100 100	Lab Course II-100
Sem. IV	**Elective A :**		
	I. Biochemistry(Compulsory) II. Limnology(Compulsory)	100 100	Lab Course I-100
	III. Ichthyology(Optional) IV. Pisiculture and Fishery Economics (Optional)	100 100	Lab Course II-100
	Elective B:		
	I. Biochemistry(Compulsory) II. Neurophysiology(Compulsory)	100 100	Lab Course I- 100
	III. Entomology(Optional) IV. Applied Entomology(Optional)	100 100	Lab Course II- 100
		1600	**800 = 2400**



M.Sc. ZOOLOGY
(2025-26)
Semester - I
Paper –I
Biosystematics & Taxonomy M.M.-80

Session: 2025-26	**Program: M.Sc.**
Semester: I	**Paper - I**
Credit: 04+02 (L+P)	**Lecture 60 + 30**
MM: 80	**Minimum Passing Marks: 35**

Objectives	• **To provide foundational knowledge of biosystematics and taxonomy**, including historical perspectives, taxonomic hierarchy, theories of classification, and their importance in biodiversity conservation. • **To equip students with the principles and practices of scientific nomenclature and taxonomic identification**, covering taxonomic characters, ICN rules, keys, typification, and species concepts. • **To introduce modern tools and emerging approaches in biosystematics**, such as molecular taxonomy, numerical methods, DNA barcoding, and phylogenetic analysis for constructing evolutionary relationships.	
Learning outcome	• Students **will be able to explain the fundamental concepts, hierarchy, and historical development of biosystematics and taxonomy**, including their significance in biological research and conservation efforts. • Students **will develop the ability to identify and classify organisms using various taxonomic characters, scientific nomenclature principles, and taxonomic keys**, as per the guidelines of the International Code of Nomenclature (ICN). • Students **will gain practical knowledge of modern techniques and trends in Systematics**, including molecular taxonomy, numerical methods, and DNA barcoding, for understanding evolutionary relationships and species identification.	
Credit detail	**Unit**	**Syllabus**
Credits: 4 ▪ **Max. Marks: 100** ▪ **Theory: 100 (80+20)**	I (15 Lecture)	**Introduction to systematic and classification:** 1. Definition & basic concepts of Biosystematics and Taxonomy. Historical resume of systematic. 2. Taxonomic Hierarchy: Definition, Linnaean hierarchy and categories. 3. Classification: Purpose, use and basis. 4. Theories of Classification: Biological, artificial and natural classification. Levels of taxonomy: alpha, beta and gamma taxonomy. 5. Micro and macro taxonomy. 6. Scope and applications of biosystematics in biology. 7. The relevance of systematic in conservation programs.
	II (15 ectur e)	**Taxonomic Characters and Scientific Nomenclature:** 1. Different types of taxonomic characters (morphological, physiological, ecological, ethological and geographical characters**).** 2. **Zoological nomenclature:** binominal and trinomial system, Principles and rules of International Code of Nomenclature (ICN), type material, author citation, Criteria for publication, types of names, principle of priority and its limitations.
	III	**Taxonomic Keys, Taxonomic treatment and**

	(15 Lecture)	**Phylogenetics:** 1.Types of taxonomic key their merits and demerits. 2. Type concept : Process of typification and different Zoological types and their applications. 3.Taxonomic treatment of Allopatric variation, homology and Reproductive and geographical isolating mechanisms and their role in Speciation process. 4. Evolutionary taxonomy: Cladistics. Constructing trees/ dendrograms : Phenogram, phylogram and cladogram and turning Them into classifications. 5.Mechanism of speciation in panmictic and apomictic species. 6.**Species concept:** different species concepts, **Species category:** sub-species and other infra species categories.
	IV (15 Lecture)	**Procedure and Newer trends in biosystematics:** 1.Taxonomic Collection, Curetting, preservation, identification and classification. 2.**Newer trends in biosystematics:** Morphological, Embryological, Behavioral, Ecological, Cytological and Biochemical approach. 3.Numerical taxonomy. 4.Differential systematic. 5.Molecular Taxonomy. 6.DNA bar coding for identification of species.
Suggested Books:	1. Biosystematics & Taxonomy – Dr.R.C. Tripathi. 2. Theory and practice of Animal Taxonomy – V.C. Kappor. 3. Principal of Animal Taxonomy – G.G. Simpson. 4. Elements of Taxonomy – Earnst Mayer. 5. Principle of Animal Taxonomy; G.G. Simpson. Oxford IBH Publishing Company.	

Evaluation Scheme-	Section in question Paper	Question Type	Word Limit	No. of Questions	Marks per question.	Total
External	A	Very short answer type	50		3	12
	B	Short Answer type	100	4	5	20
	C	Long Answer Type	200	4	12	48
Internal	Based on CT & Project					20
Total						**100**

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M.Sc. ZOOLOGY
(2025-26)
Semester - I
Paper –II
Biotechnology & Genetic Engineering M.M.-80

Session: 2025-26	**Program: M.Sc.**
Semester: I	**Paper: II**
Credit: 04+02 (L+P)	**Lecture 60 + 30**
MM: 80	**Minimum Passing Marks: 35**

Objectives	• T**o provide students with a comprehensive understanding of the principles, techniques, and ethical considerations of biotechnology**, including recombinant DNA technology, gene transfer methods, and PCR. • **To introduce students to core concepts and methods in genetic engineering**, such as genomic and cDNA libraries, gene sequencing, gene editing, stem cell technology, and transgenic animal production. • **To familiarize students with the applications of biotechnology in modern science and bioinformatics**, including genetic modification, therapeutic innovations, and the use of biological databases and computational tools for molecular data analysis.	
Learning outcome	• Students **will be able to explain the fundamental concepts and techniques of biotechnology**, including recombinant DNA technology, gene transfer methods, PCR, and DNA/RNA purification, along with their applications and ethical implications. • **Students will acquire knowledge and practical understanding of genetic engineering tools and techniques**, such as gene cloning, genome sequencing, gene editing (including CRISPR-Cas9), transgenesis, and the use of stem cells and animal cell cultures in biotechnology. • **Students will develop the ability to apply bioinformatics tools and databases** (e.g., BLAST, FASTA, GENBANK, PDB) for analyzing biological sequences and structures, and understand their relevance in genomics, proteomics, and the advancement of molecular biology.	
Credit detail	**Unit**	**Syllabus**
Credits: 4 ▪ Max. Marks: 100 ▪ Theory: 100 (80+20)	I (15 Lecture)	**Introduction to Biotechnology :** **1.** An overview of Biotechnology: History, Definition, scope, applications and ethical issues in biotechnology. Recombinant DNA , Restriction Enzymes, Application of different enzymes in Recombinant DNA technology, Restriction and modification system, Linkers & Adaptors, Restriction mapping. **2.** Vectors (Cloning and Expression Vectors) Gene Recombination and Gene transfer: Transfection, Transduction,Microinjection, Electroporation and Ultrasonication Antibiotic Resistant Gene and their mode of action. **3.** Polymerase chain reaction (PCR) : Principle and applications ofdifferent types of PCR . **4.** DNA and RNA Purification.
	II (15 Lecture)	**Elementary Genetic Engineering:** **1.** Preparation and comparison of Genomic and cDNA library, screening of recombinants, Genome: organization, coding and non -coding sequences & genome mapping, Comparative genome hybridization. **2.** Whole genome shotgun sequencing, Chromosome Banding. Gene

		tagging, DNA Cloning, DNA Sequencing methods , DNA profiling. **3.** Genetic Markers, Molecular markers: Types & Features. **4.** Stem Cells**:** Embryonic Stem Cells , Adult Stem Cells and Induced Pluripotent Stem Cells, Formation and selection of recombinant ES cells, Role of ES cells in gene targeting in mice, Gene Probe, Colony Hybridization, Blotting Techniques (Southern, Northern, Western and Eastern Blotting) , Animal Cell Culture (Primary Cultures, Cell line, Transformation characteristics, Culture Media & Growth Cycle).
	III (15 Lecture)	**Advancements in Genetic Engineering :** **1.** Random and site - directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis. **2.** Gene Editing, Gene shuffling, Genetic Manipulation of Animal Cells (Transgenesis and transgenic animals), Gene Knockout, Nuclear Transfer Technology and Animal Cloning, Gene Therapy, Gene Delivery System (Virus mediated transduction & non viral transduction methods). **3.** Molecular Farming (Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines), Microarrays and next generation sequencing technologies.
	IV (15 Lecture)	**Applications of Genetic Engineering & Bioinformatics :** **1.** Cord blood banking, Genetically Modified Organism (GMO), Animals as bioreactors: Genetically engineered animals for research. Conditional knock outs using cre-loxP recombination; tissue specific promoters, CRISPR-Cas9 and its applications in treating genetic disorders. **2.** Genetic modification of livestock for improved productivity and disease resistance. Ethical, Legal, and Social Implications (ELSI) of genetic engineering. **3.** Bioinformatics: Overview and its relation with molecular biology. Biological Databases: Overview, Applications & Prospects .Examples of related tools(FASTA, BLAST, BLAT, RASMOL), databases(GENBANK, Pub med, PDB) and software(RASMOL,Ligand Explorer), Data generation; Generation of large scale molecular biology data. (Through Genome sequencing) File Format (Gene bank, DDBJ, FASTA, PDB, Swiss Prot). **4.** Sequence gnments and Visualization, General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). **5.** Protein databases (Primary, Composite, and Secondary). **6.** Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDB sum).
Suggested Books:	***Text BooksRecommended –*** • Lehninger –Principles of Biochemistry, WH Freeman. • Satyanarayan U - Biotechnology, Saras Publication . • Gupta P.K. –Elements of Biotechnology, Rastogi Publications. • Gupta P.K. Biotechnology and Genomics, Rastogi Publications. • Kumar Pranav, Verma Praveen, Meena Usha – Biotechnology: A problem approach- Pathfinder Publications. • Rastogi S.C., Rastogi P., MendirattaN :Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery, PHI Learning. • Bosu Orpita, Thukral S .K.- Bioinformatics: Experiments, Tools, Databases, and logrithms – Oxford University Press. • ***Reference Books Recommended –*** • Lodish H et al.,- Freeman	

	• Watson JD et al.-Macmillan - Recombinant DNA: Genes and Genomes, A Short Course. • Alberts B et al., Molecular Biology of the Cell, - Garland • Brown TA – Genomes, Garland

Evaluation Scheme-	Section in question Paper	Question Type	Word Limit	No. of Questions	Marks per question.	Total
External	A	Very short answer type	50	4	3	12
	B	Short Answer type	100	4	5	20
	C	Long Answer Type	200	4	12	48
Internal	Based on CT & Project					20
Total						**100**

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M.Sc. ZOOLOGY
(2025-26)
SEMESTER - I
Lab Course- I based on Theory Paper I & II M.M- 100

I -Biosystematics and taxonomy

1. Study and sketch of museum specimens of Invertebrates and Vertebrates on the basis of systematic and Taxonomic Hierarchy
2. Preparation of identification keys for select specimens of non chordate (e.g., insects) and chordates (e.g., birds).
3. Make a record of biodiversity of college campus. Construct the dendrograms , through Interactive software for exploring phylogeny and analyzing character
4. Use DNA bar coding for identification of species.
5. General discussion, distinguishing characters and classification of selected animals.
6. Generation of a character -state matrix by selecting and scoring diagnostic taxonomic characters.
7. Distance -based methods of phylogenetic reconstruction using manual and computer methods.
8. Group discussion/Viva or Seminar presentation on two related topics
9. An "animal album or Practical Record" containing sketches, photographs, cut outs, with appropriate writes up about the above mentioned taxa.
10. Study of some videos to develop understanding on the animals of different taxa.

II - Biotechnology & Genetic Engineering

1. Sterilization of glassware, media and laboratory.
2. Working principle and applications of - Hot Air Oven, Autoclave & Laminar flow hood.
3. Demonstration of cell culture techniques.
4. Demonstration of gene library and cDNA library.
5. Isolation of DNA from plant sample
6. Isolation of plasmid DNA from E. coli cells
7. Isolation of genomic DNA from whole blood.
8. Demonstration of Gel electrophoresis techniques.
9. Separation and visualization of DNA fragments using agarose gel electrophoresis.
10. Spectrophotometric estimation of isolated DNA.
11. Restriction digestion of plasmid DNA and genomic DNA.
12. Study related to working principle of PCR machine.
13. Preparation of Minimal Essential Growth medium.
14. Staining the cultured cells using dyes such as heamatoxylin and eosin (H&E), and
15. Observe them under a light microscope to study cell morphology and structure.
16. B0ioinformatics: Analyze DNA or protein sequences using online tools and databases.
17. Demonstration of online data bases for bioinformatics based studies.
18. Demonstration of DNA band visualization techniques (e.g., Ethidium bromide staining, DNA intercalating dyes)
19. Group discussion/ Quiz/Project/Seminar presentation on related topics.

Note: *Virtual mode of demonstration can be opted if required.*

Scheme of Examination

Time – 6 hours

1. Based on paper III	-	**35**
2. Based on paper IV	-	**35**
3. Viva	-	**10**
4. Sessional(Internal)	-	**20**

Total = 100 Marks

M.Sc. ZOOLOGY
(2025-26)
Semester - I
Paper –III
Immunology

M.M.-80

Session: 2025-26	**Program: M.Sc.**
Semester: I	**Paper: III**
Credit: 04+02(L+P)	**Lecture 60 + 30**
MM: 80	**Minimum Passing Marks: 35**

Objectives	• **To introduce students to the structure, components, and functions of the immune system**, including innate and adaptive immunity. • **To explain the molecular and cellular mechanisms of immune responses**, such as antigen recognition, antibody production, and antigen-antibody interactions. • **To familiarize students with immune disorders and immunological techniques**, including hypersensitivity, autoimmunity, vaccination, ELISA, and immunofluorescence.	
Learning outcome	• **Students will be able to describe the components and functions of the immune system**, including lymphoid organs, immune cells, and immune responses. • **Students will understand the mechanisms of antigen recognition, antibody production, and immune regulation**, including MHC presentation and cytokine signaling. • **Students will be able to identify and explain immune disorders and apply key immunological techniques**, such as ELISA, immuno-electrophoresis, and fluorescence-based assays, in clinical and research contexts.	
Credit detail	**Unit**	**Syllabus**
Credits: 4 ▪ Max. Marks: 100 ▪ Theory: 100 (80+20)	I (15 Lecture)	**Understanding of Immunological Concepts:** **1.** Immune System : Brief history of Immunity, Concept & Types of Immunity (Innate and Acquired or Adaptive), Origin and Evolution of Immune System. **2.** Primary and Secondary lymphoid organs, lymphoid tissues. **3.** Thymic Selection : Self and non self-recognition. Inflammation. Lymphocyt e trafficking Hematopoiesis.
	II (15 Lecture)	**Components of Immune System I :** **1.** Cells of Immune System: Structure and functions of macrophages, granulocytes, NK cells, T and B lymphocytes and Antigen presenting cells. **2.** T & B Cell receptors, maturation, activation and differentiation of T& B. **3.** Cell Antigen: Antigenicity v/s immunogenicity, F Factors affecting Immunogenicity, immunogen, haptens,super antigen, epitope, paratope. Adjuvants: Freund's complete and incomplete. **4.** Processing and presentation of Ag.Major histocompatibility complex (MHC) and HLA. Cytokines
	III (15 Lecture)	**Components of Immune System-II :** **1.** Immunoglobulins : Nature, Primary structure of Immunoglobulins. **2.** Enzymatic fragmentation of Ig. Domain structure of Ig and its significance. **3.** Types and subtypes of Ig and its characteristics .Membranous antibody**.** **4.** Antigenic determinants : isotype, allotype, idiotype . Abzymes.

		5. Theories of Antibody Formation : Instructive, selective, clonal selection theories and evidences; Immunological memory. **6.** Complement System. Hypersensitivity (Type I to IV with example) CMI & humoral immune response. **7.** Antigen - Antibody interaction : affinity & avidity.
	IV (15 Lecture)	**Immune disorders &Immuno-techniques :** **1. Auto -immunity:** Auto -recognition, classes of auto-immuno diseases.(Hashimoto disease, Thyrotoxicosis, Systemic lupus erythematosus, Rheumatoid arthritis). **2.** Transplantation: Autograft, Isograft, Allograft, Xenograft, Immunological basis of transplantation reactions. Immune Deficiencies:Primary and secondary immune deficiencies. **3.** T-cell, B-cell and SCID, AIDS.Vaccination and types of vaccines (First,Second & Third generation vaccines). Immunological techniques: Precipitin curve, Immuno -diffusion, one and two dimensional, single radial immune - diffusion, (Double Ouchterlony) immune - diffusion. **4.** Immuno-electrophoresis: Rocket immuno-electrophoresis; CIE, Graber and William technique. **5.** Radio-immunoassay: ELISA–Principle, Methodology and applications. **6.** Immuno-fluorescence: Direct, indirect and Sandwich, in situ localization by techniques :FISH and GISH Hybridoma, Monoclonal antibodies.
Suggested Books:	***Text Books Recommended –*** • Pravash Sen. Gupta, Clinical Immunology. Oxford University Press. 2003. • N Arumugam, Immunology, Saras Publication. 2014. • Fatima D, Arumugam, Immunology , Saras Publication ***Reference Books Recommended –*** • Janis Kuby, Immunology, II edition. W. H. Freeman and Company, New York. 1993. • Ivan M. Roitt, J. Brostoff and D. K. Male, Immunology, Gower Medical Publishing, London.1993.	

Evaluation Scheme-	Section in question Paper	Question Type	Word Limit	No. of Questions	Marks per question.	Total
External	A	Very short answer type	50	4	3	12
	B	Short Answer type	100	4	5	20
	C	Long Answer Type	200	4	12	48
Internal	Based on CT & Project					20
Total						**100**

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M.Sc. ZOOLOGY
(2025-26)
Semester - I
Paper –IV
Parasitology M.M. 80

Session: 2025-26	**Program: M.Sc.**
Semester: I	**Paper: IV**
Credit: 04+02(L+P)	**Lecture 60 + 30**
MM: 80	**Minimum Passing Marks: 35**

Objectives	• **To provide students with fundamental knowledge of the structure, classification, and pathogenic mechanisms** of viruses, bacteria, fungi, protozoa, and helminths. • **To enable students to understand the pathogenesis, clinical features, and preventive strategies** for major infectious diseases affecting humans. • **To develop awareness of disease transmission, zoonotic infections, and the role of vectors**, along with basic approaches to diagnosis and treatment.	
Learning outcome	• **Students will be able to describe the structure, classification, and pathogenic mechanisms** of viruses, bacteria, fungi, protozoa, and helminths causing human diseases. • **Students will gain knowledge of the life cycles, transmission, symptoms, and preventive measures** for key infectious diseases including hepatitis, tuberculosis, malaria, and helminthiasis. • **Students will understand the principles of host-pathogen interactions**, zoonotic transmission, and the role of vectors in disease spread.	
Credit detail	**Unit**	**Syllabus**
Credits: 4 ▪ Max. Marks: 100 ▪ Theory: 100 (80+20)	I (15 Lecture)	**Viral diseases:** 1. General characters, Structure and Classification of virus **,** A brief account of pathogenic viruses. 2. Brief history of microbiology : germ theory of disease, Host pathogen interaction: invasion, antigenic heterogeneity, toxins and enzymes Secretions. 3. Viral diseases: hepatitis, influenza, AIDS, Covid -19 with emphasis on their causative agents, pathogenesis, diagnosis, prophylaxis and chemotherapy.
	II (15 Lecture)	**Acterial &Fungal diseases** : 1. General characters, Structure and Classification of bacteria. 2. **Bacterial Diseases :** A brief account of pathogenic bacteria , discovery of penicillin, diseasescaused by *Streptococcus pneumonia, Salmonella typhi, Escherichia coli, Mycobacterium tuberculosis, Rickettsia, Spirochaetes.* 3. **Fungal diseases:** Ringworm infection , *Aspergillosis, candidiasis.*
	III (15 Lecture)	**Protozoan parasites: An** overview of protozoa & disease. 1. Introduction to parasites and parasitic diseases. 2. Mode of transmission, portals of entry and implications of Parasitism. 3. Parasitic adaptations. 4. Concept of zoonotic diseases.

		5. Protozoan diseases of medical importance: Brief account of life History, pathogenicity of the following Protozoa with reference to Man, prophylaxis and treatment :*Entamoeba histolitica, Trypanosoma gambiens, Plasmodium vivex , Giardi.*
	IV (15 Lecture)	**Helminth parasites:** An overview of Helminthes diseases.Brief account of life **1.** History, pathogenicity of the following Helminths with reference to Man, prophylaxis and treatment - *Taenia solium, Schistosoma haematobium, Ascaris lumbricoides, Wuchereria branrofti.* **2.** Vector insects.
Suggested Books:	***Text Books Recommended –*** • Agrawal Anju Principles of Toxicology. • Parija, S. C. (2013) Textbook of Medical Parasitology, Protozoology & Helminthology (Text and color Atlas), IV Edition, All India Publishers & Distributers, New Delhi. • Ichh pujani, R.L. and Bhatia, R. (2009) Medical Parasitology. III Edition, Jaypee BrothersMedical Publishers (P) Ltd., New Delhi. • Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor andFrancis Group. • Chatterjee, K. D. (2009). Parasi tology: Protozoology and Helminthology. XIII Edition, CBSPublishers & Distributors (P) Ltd. • Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributors. • Chatterjee, K.D (2015) Parasitology (13th edition) ***Reference Books Recommended –*** • Jawetz, M. and Adelberg (2015) Medical Microbiology (27th edition) • Noble, E.R. and Noble, G.A. (1989) Parasitology: The Biology of Animal Parasites. VIEdition, Lea and Febiger.	

Evaluation Scheme-	Section in question Paper	Question Type	Word Limit	No. of Questions	Marks per question.	Total
External	A	Very short answer type	50	4	3	12
	B	Short Answer type	100	4	5	20
	C	Long Answer Type	200	4	12	48
Internal	Based on CT & Project					20
Total						**100**

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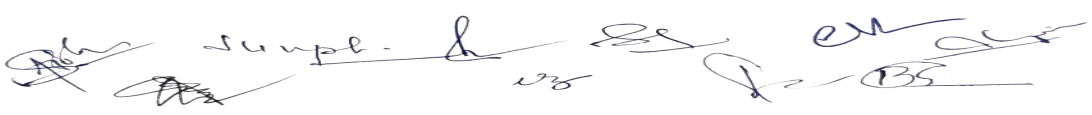

M.Sc. ZOOLOGY
(2025-26)
SEMESTER - I

A. Lab course-II Practical based on theory Paper III & IV M.M- 100

III - IMMUNOLOGY

1. Study of permanent slides of organs of immune system
2. Enumeration of total leucocytes from human blood samples
3. Enumeration of differential leucocytes from human blood samples
4. Demonstration of agglutination reaction using human RBC
5. Demonstration of Ag-Ab precipitation by immunodiffusion technique
6. Antigen detection by radial immunodiffusion technique (RID)
7. Estimation of total serum protein
8. Estimation of serum gamma globulins/Separation of globulin by salt precipitation.
9. Estimation of A/G ratio
10. Isolation of lymphocyte by using density gradient centrifugation
11. Paper and gel immune electrophoresis
12. Rocket immunoelectrophores is
13. Counter current immunoelectrophoresis
14. ELISA
15. Groupdiscussion/Quiz/Seminarpresentationonrelatedtopics
16. Making of Pract ical record.

IV- PARASITOLOGY

1. Study of permanent slides and specimens of parasitic Protozoans and Helminthes.
2. Pathological examination of sputum, blood, urine and stool.
3. Blood: Erythrocyte Sedimentation Rate (ESR), Haematocrit.
4. Staining and identification of Grampositive and Gram negative bacteria.
5. Preparation of thin and thick blood films to diagnose Plasmodium infections/ or permanent slides.
6. Preparation of temporary and permanent slides of faecal matter by saline
7. preparation and concentration techniques to identify cysts of parasitic Protozoan's and
8. Helminthes eggs /or permanent slides studies.
9. Study Kinetics of bacterial growth and staining techniques.
10. Group discussion or Seminar presentation on one or two related topics
11. Group discussion/quiz seminar on topics related to theory.
12. Preparation of practical record or Album of parasites.

Scheme of Examination

Time – 6 hours

1. Based on paper III	-	**35**
2. Based on paper IV	-	**35**
3. Viva	-	**10**
4. Sessional(Internal)	-	**20**

Total = 100 Marks

M.Sc. ZOOLOGY
(2025-26)
Semester - II
Paper –I
Molecular Biology M.M.-80

Session: 2025-26	**Program: M.Sc.**
Semester: II	**Paper - I**
Credit: 04+02(L+P)	**Lecture 60 + 30**
MM: 80	**Minimum Passing Marks: 35**

Objectives	• To introduce students to the structure, organization, and functional dynamics of chromosomes and nucleic acids in prokaryotic and eukaryotic systems. • To provide understanding of fundamental molecular mechanisms including DNA replication, transcription, RNA processing, and translation. • To familiarize students with gene expression regulation, mutation, DNA repair systems, RNA silencing, and modern tools like CRISPR technology.	
Learning outcome	• Students will be able to describe the structure and function of chromosomes, DNA, and RNA, including chromatin organization and various forms of nucleic acids. • Students will understand the molecular processes of DNA replication, transcription, RNA processing, and translation in both prokaryotic and eukaryotic cells. • Students will be able to explain gene regulation mechanisms, mutation types, DNA repair, and advanced concepts like RNA silencing and CRISPR technology.	
Credit detail	**Unit**	**Syllabus**
Cradits: 4 ▪ **Max. Marks: 100** ▪ **Theory: 100 (80+20)**	I (15 Lecture)	**Chromosomes and Nucleic Acids:** Chromosomes structure: Chromatin (Euchromatin and heterochromatin), Types of chromosomes. Histones, Histone modifications. Structure of Nuclic acids: Structure and functions of DNA , DNA forms: Plasmid DNA,Genomic DNA And Repetitive DNA. DNA polymorphisms. DNA modifications. Structure and Function of RNA: Ribosomal RNA (rRNA), Transfer RNA (tRNA), Messenger RNA (mRNA) , Noncoding RNA. RNA Induced Silencing Complex and CRISPR Technology. Mutation: Chromosomal and gene mutation.
	II (15 Lecture)	**Central dogma and DNA replication:** Central dogma of Molecular Biology. DNA methylation. DNA - Protein interaction. DNA Replication , plasmid DNA replication and genomic DNA replication, Centromeric and Telomeric DNA replication, DNA replication and cell cycle regulation. DNA polymerases. DNA damaging agents. DNA repairing.
	III (15 Lecture)	**Transcription:** Concept of Transcription, RNA polymerase I, II, III, transcription factors. RNA processing, splicing of hnRNA into mRNA,

		5'capping and 3' polyadenylation of mRNA, rRNA and tRNA modifications and processing. RNA editing, alternative splicing, trans-splicing, miRNA, siRNA, piRNA, lncRNA, RNA-protein complex.
	IV (15 Lecture)	**Translation:** Structure of Ribosome, Genetic Code, triplet codons, Wobble base , Synonymous codons, degeneracy of codon . Translation in prokaryotic and Eukaryotic cells (Aminoa cylation of t-RNA, initiation, elongation, peptide bond formation, translocation, Termination, recycling of ribosome). Post-translational modifications and processing of proteins, large protein-protein complexes and protein trafficking Reregulation of protein synthesis in prokaryotic and eukaryotic cell.
Suggested Books:	***Text Books Recommended –*** • Chaudhari K, Molecular Biology Text book IFAS Publication • Verma P.S., Agrawal V.K., Molecular Biology S Chand. ***Reference Books Recommended-*** • Watson, J.D. *et al.* (2013) Molecular Biology of the Gene (7th edition) CSHL Press Pearson. • Green, M. R and Sambrook, J. (2012) Molecular Cloning: a Laboratory Protocol (4th edition) CSHL Press. • Walter, P. (2007) Molecular Biology of the Cell (5th edition) Garland Science. • Cell Biology by De Roberties • Gene by Lewine 7 th to 11thedition	

Evaluation Scheme-	Section in question Paper	Question Type	Word Limit	No. of Questions	Marks per question.	Total
External	A	Very short answer type	50	4	3	12
	B	Short Answer type	100	4	5	20
	C	Long Answer Type	200	4	12	48
Internal	Based on CT & Project					20
Total						**100**

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M.Sc. ZOOLOGY
(2025-26)
Semester - II
Paper –II
Biotechniques M.M.-80

Session: 2025-26	**Program: M.Sc.**
Semester: II	**Paper - II**
Credit: 04+02(L+P)	**Lecture 60 + 30**
MM: 80	**Minimum Passing Marks: 35**

Objectives	• To understand the principles, configurations, and applications of various microscopes including light, phase contrast, fluorescence, confocal, and electron microscopes. • To learn the techniques of microtomy including tissue preparation, sectioning, staining, and slide preparation for microscopic analysis. • To gain practical knowledge of laboratory tools and techniques such as chromatography, electrophoresis, cell culture, sterilization methods, and lab bioethics for safe and effective biological research.	
Learning outcome	• Students will be able to explain the principles, working, and applications of various types of microscopes and perform microscopic analysis of biological samples. • Students will acquire practical skills in microtomy, including tissue preparation, sectioning, staining, and permanent slide preparation for detailed microscopic examination. • Students will demonstrate proficiency in using laboratory techniques such as chromatography, electrophoresis, cell culture, sterilization, and adhere to lab safety and bioethics protocols.	
Credit detail	**Unit**	**Syllabus**
Cradits: 4 ▪ **Max. Marks: 100** ▪ **Theory: 100 (80+20)**	I (15 Lecture)	**Microscopy and Microtomy:** **1. Types of Microscope:** Basic Principle, configuration and working of Light Microscope (Bright and Dark Field), Magnification & Resolution, and Numerical Aperture,Phase Contrast Microscope, Fluorescence Microscope,Conifocal Microscope Electron Microscope (SEM and TEM). **2. Microtomy** : Permanent slide preparation Through microtome :Tissue-preparation fixation, dehydration, **block** –preparation, trimming, **Cutting sections (sectioning / Ribbon) -** handling, affixing on the side, labeling and storage , **staining** the microtomy slides.
	II (15 Lecture)	**Tools and techniques in Physiology:** Principle and applications of pH meter, Centrifugation, Colorimetry and Spectrophotometry -UV, visible spectrophotometer, Infra-red spectrophotometer, NMR and ESR.
	III (15 Lecture)	**Chromatography and Electrophoresis:** **1. Chromatography:** Principle and Applications of Paper chromatography, Thin layer chromatography and Gel-filtration chromatography. 2. **Electrophoresis:** Principle and Applications of Agarose gel electrophoresis, Polyacrylamide, Gel electrophoresis , PAGE,2D PAGE.
	IV (15 Lecture)	**Cell culture and Lab Bioethics:** **1.** Cell culture and its basic requirements.

		2. **Culture media:** Nutrient and Non-nutrient media, Types of animal cell culture : Pure Culture - Pour Plate Method, Streak Plate Method and Spread Plate Method. 3. **Media preparation** of Animal Cell culture, viability testing, cell harvesting and storage method with special reference to Lymphocytes and stem cell culture. 4. *In Vitro* cultureof Entamoeba *histolytica*, *Coenorhabditis elegans* 5. **Sterilization technique** (Physical Method: Autoclave sterilization , Hot air Sterlization, U V sterilization, filtration and chemical Method: alcohol, Formalin and Chromic acid), sterilization of glass wares, Media and laminar flow, Flow cytometery. 6. **Lab Bioethics:** Lab safety, disposal of bio –waste.
Suggested Books:	• Robert Braun, Introduction to instrumental analysis, McGraw Hill Publication • Clark and Swizer, Experimental Biochemistry, Freeman, 2000 • Boyer, R. (2000) Modern Experimental Biochemistry (3rd edition) Benjamin-Cummings. **Recommended readings:** • Pearse, A.G.E. (1980-1993) Histochemistr-Theoretical and applied, Volume I -III, Churchill - Livingstones. • Plummer, D. (2017) An Introduction to Practical Biochemistry (3 rd edition) McGraw Hill. • Wilson, K. and Walker, J. (2010) Experimental Biochemistry, Cambridge. Practical. • Swarup N, Arora S and Pathak SC, Laboratory Techniques in Modern Biology. Kalyani Publishers. • SharmaB.K,Principles of Instrumentation Goel Publishing House • Upadhayay Upadhayay & Nath, Principles of Instrumentation , Himalaya Publishing House. • Chatwal G R&Anand Sharma , Principles of Instrumental method of Chemical Analysis, HimalayaPublishing House. • Arumugam N, Kumaresan V, Biotechniques Saras Publication. • Ghatak K L, Techniques and Methods in Biology PHI Learning	

Evaluation Scheme-	Section in question Paper	Question Type	Word Limit	No. of Questions	Marks per question.	Total
External	A	Very short answer type	50	4	3	12
	B	Short Answer type	100	4	5	20
	C	Long Answer Type	200	4	12	48
Internal	Based on CT & Project					20
Total						**100**

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M.Sc. ZOOLOGY
(2025-26)
SEMESTER - II

A. Lab course-I Practical Based on Paper I& II M.M- 100

I- Molecular Biology

1. Preparation of ball and stick model for B-DNA molecule (A=T and G=C base pairs).
2. Preparation of RNA model for tRNA, mRNA and rRNA molecule (A=U and G=C base pairs)
3. Preparation of Central dogma model with reference to Replication, Transcription and Translation i.e., Linear flow of genetic information.
4. Isolation of genomic DNA by ethanol precipitation method.
5. Preparation of model pBR322
6. Agarose gel electrophoresis of the plasmid DNA and the genomic DNA.
7. Chromosomal staining
8. Temporary slide preparation of Salivary gland chromosome from drosophila larva
9. Group discussion/Quiz/Seminar presentation on related topics.
10. Practical Record or Lab assignment.

II- Biotechniques

1. Study and handling of Compound Microscope, pH meter, Colorimeter, Centrifuge,
2. Spectrophotometer, Chromatography Chamber, ElectrophorosisUnit, Microtome.
3. Sterilization of Lab equipments.
4. Determination of pH of different soil samples & water samples.
5. Determination of maximum absorption.
6. Separation of Amino acids, plant pigment and sugar by paper and thin layer
7. chromatography
8. Separation of DNA and RNA through Paper & Gel Electrophoresis
9. Separation of particles by Centrifuge. Preparation of Permanent slides through Microtome.
10. Preparation of Temporary and Permanente slides of some microscopic organisms.
11. Pure culture of cell.
12. Cell fractionation
13. Contour drawing through Camera Lusida Preparation of Practical Record.
14. Group discussion/Viva or Seminar presentation on above mentioned topics.

Scheme of Examination

Time – 6 hours

5. Based on paper III	-	**35**
6. Based on paper IV	-	**35**
7. Viva	-	**10**
8. Sessional(Internal)	-	**20**

Total = 100 Marks

M.Sc. ZOOLOGY
(2025-26)
Semester - II
Paper –III
Developmental Biology M.M.-80

Session: 2025-26	**Program: M.Sc.**
Semester: II	**Paper - III**
Credit: 04+02(L+P)	**Lecture 60 + 30**
MM: 80	**Minimum Passing Marks: 35**

Objectives	• To understand the origin, structure, formation, and biochemical regulation of male and female gametes, including fertilization processes and causes of infertility. • To study embryological development stages such as cleavage, germ layer differentiation, morphogenesis, organogenesis, and mechanisms of regeneration and metamorphosis. • To explore advanced reproductive technologies, reproductive health issues, and the impact of teratogens, endocrine disruptors, and sexually transmitted diseases on human reproduction.	
Learning outcome	• Students will be able to explain the processes of gamete formation, fertilization, and early embryonic development, including the biochemical and physiological mechanisms involved. • Students will understand key concepts of embryology such as cleavage, germ layer differentiation, morphogenesis, organogenesis, and the regulation of development and regeneration. • Students will gain knowledge about reproductive technologies, causes and treatments of infertility, and the impact of teratogens, endocrine disruptors, and sexually transmitted diseases on reproductive health.	
Credit detail	**Unit**	**Syllabus**
Cradits: 4 ▪ **Max. Marks: 100** ▪ **Theory: 100 (80+20)**	I (15 Lecture)	**Gametes Biology :** • Biology of sexed termination and differentiation , Origin of primordial germ cells. • Morphology of different types of gametes Male gamete and female gamete. • Formation of Gametes: Process of Spermatogenesis. , Biochemical changes in spermatogenesis and control of spermatogenesis, Seminat ion. • Process of Oogenesis, Biochemical changes in Oogenesis and control of Oogenesis ,Vitellogenesis . • Structure and composition of yolk . • Ovulation and ovum transport in mammals. • Infertility in Male and female: Causes and Cure. • Fertilization: external and internal fertilization, Recognition of gametes, capacitation, acrosome reaction, activation of egg metabolism, migration of pronuclei, amphimixis and post fertilization changes in the egg cytoplasm. • Block to polyspermy. Parthenogenesis.
	II (15 Lecture)	**Embryology :** Cleavage pattern and mechanism of cleavage, physiology of cleavage Mosaic and regulative development, Direct and indirect development, Body plan and symmetries.

		Germ layer differentiation. Tubulation. Morphogenesis: Epiboly,Emboly/ invagination, involution and ingression. Fate maps: Methods of construction of fate map, fate map of Amphioxus, Amphibians and Chick. Formative movements, Metamorphosis: Innsect and in frog. Hormonal regulation of metamorphosis. Cell signaling, cell adhesion during tissue organization, lateral inhibition, induction, and recruitment. Organogenesis: formation of gut, heart, idneyandmuscles , molecular mechanism involved. Pleuropotency.
	III (15 Lecture)	**Developmental Biology:** • **Organizer concept:** Types, characteristics & mechanism of organizer. • Extra embryonic membranes: Development and functions in chick. Axis Formation in Drosophila,Metamorphosis in insect and in Frog. Hormonal regulation of metamorphosis. • Placenta: Structure, functions and its types. • Regeneration: Types - epimorphosis, morphollaxis and compensatory regeneration , mechanisms and physiological processes involved in regeneration, ability of regeneration in invertebrates and vertebrates, difference between embryogenesis and regeneration and tissue repair. • Concept of competence, determination and differentiation and growth Ageing and apoptosis.
	IV (15 Lecture)	**Reproductive Technology and Reproductive Health :** ***In vitro*** **fertilization:** • Artificial insemination (AI); Gamete intra-fallopian transfer (GIFT) , Intra -cytoplasmic sperm injection(ICSI) , Zygote Intra Fallopian Transfer (ZIFT), Test tube baby. • Causes of Infertility. Multiple ovulation and embryo transfer Technology (IVF and IVET) , Pre implantation genetic diagnosis (PGD) Ethics in surrogacy. • Teratology & teratogens: wound healing, birth defects, developmental brain disorders. • Neuro degeneration. Endocrine Disruptors & Cancer. • Causes of Sexually transmitted diseases: HIV/AIDS & Human Papillomavirus (HPV), Syphilis Menstrual Disorders, Polycystic Ovarian Disease & Polycystic Ovarian Syndrome (PCOD & PCOS).
Suggested Books:	***Text BooksRecommended –*** • Agrawal V K, Evolution and Developmental Biology, S Chand Publication • Verma P S, Agrawal V K, Chordate Embryology, S Chand Publication • Arumugam N, Embryology , Saras Publication • Shasrti K V, Shukla Vinita, Developmental Biology, Rastogi Publication ***Reference Books Recommended –*** • Gerhart, J. et al. (1997) Cells, Embryos and Evolution. Blackwell Science • Gilbert, S.F. (2010) Developmental Biology (9th edition). Sinauer • Wolpert, L. (2007) Principles of Developmental Biology (3rd edition). Oxford University Press	

Evaluation Scheme-	Section in question Paper	Question Type	Word Limit	No. of Questions	Marks per question.	Total
External	A	Very short answer type	50	4	3	12
	B	Short Answer type	100	4	5	20
	C	Long Answer Type	200	4	12	48
Internal	Based on CT & Project					20
Total						**100**

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M.Sc. ZOOLOGY
(2025-26)
Semester - II
Paper –IV
Basics of Computer and Biostatistics M.M.-80

Session: 2025-26	**Program: M.Sc.**
Semester: II	**Paper - IV**
Credit: 04+02(L+P)	**Lecture 60 + 30**
MM: 80	**Minimum Passing Marks: 35**

Objectives	• To understand the fundamental concepts of computer structure, number systems, basic hardware and software, and to gain practical knowledge of MS Office tools and internet applications. • To learn methods of data collection, classification, and effective presentation using tables, graphs, and charts, along with calculation of measures of central tendency. • To develop skills in statistical analysis including measures of dispersion, correlation, regression, probability distributions, and hypothesis testing using various significance tests and ANOVA.	
Learning outcome	• Students will be able to explain the basic structure and classification of computers, understand number systems and conversions, and demonstrate proficiency in MS Office tools and internet applications. • Students will be able to collect, classify, and present data effectively using various tables and graphical methods, and calculate key measures of central tendency. • Students will be able to apply statistical methods including measures of dispersion, correlation, regression analysis, probability distributions, and perform hypothesis testing and ANOVA for data analysis.	
Credit detail	**Unit**	**Syllabus**
Cradits: 4 ▪ **Max. Marks: 100** ▪ **Theory: 100 (80+20)**	I (15 Lecture)	**Unit -I: Computer structure and Applications:**History of Computers, Structure of Computers, Classification of Computers, Introduction to digital computer - basic knowledge of hardware & software**,** CPU, Input and Output devices, Computer Codes : Decimal System, Binary number system, hexadecimal system, octal system, Conversion of numbers. Introduction to MS Office-MS Word, MS Excel, MS Power point, Introduction of Internet, web-mail, various search engine, Plagiarism, Artificial Intelligence (AI).
	II (15 Lecture)	**Unit-II: Data collection, presentation, and Measures of central tendency:** Collection and classification of data. Presentation of data: by Tables -rules for making tables, use of tables, Types of tables, By Graphs : rules for making graph & it's uses, Pie chart, Bar diagram, Histogram, Frequency polygon, Cumulative frequency curve (Ogive and Polygon). Measures of central tendency: Arithmetic Mean, Median, Mode.
	III (15 Lecture)	**Dispersion Correlation and Regression:** Measures of dispersion: Standard deviation and Standard error. Correlation: Types, significance and application of

		correlation, calculation of correlation in continuous data and ordinal data. Regression: Linear regression, regression coefficient.
	IV (15 Lecture)	**Probability and Analysis of Significant Test:** Probability: normal, binomial Distribution and Poisson distributions. Hypothesis testing, Test of significance: Paired and unpaired t-test and Chi square test. Analysis of Variance (one & two way ANOVA).
Suggested Books:	***Text Books Recommended –*** • Balagurusamy, E. (2011) Fundamentals of Computers, McGraw Hill Education, Rajaraman, V.: Fundamentals of Computers, 5th edition, PHI Learning Pvt. Ltd., 2010 • Sinha, P., Sinha, P.K.(2004),Computer Fundamentals: Concepts, Systems and Applications, 8th edition, BPB Publications . • Khanal, A.B. (2015),Mahajan's Methods in Biostatistics, The Health Sciences Publishers, ***Reference Books Recommended –*** • Daniel, W.W. (2012)Biostatistics: A Foundation for Analysis in Health Sciences (10th edition) John Wiley. • Milton, J.S.& Tsokos,J.O. (1992) Statistical Methods in the Biological and Health Sciences 2nd edition) McGraw Hill. • Zar, JH , (2010), Biostatistical Analysis, Prentice -Hall/Pearson, 2010.	

Evaluation Scheme-	Section in question Paper	Question Type	Word Limit	No. of Questions	Marks per question.	Total
	A	Very short answer type	50	4	3	12
External	B	Short Answer type	100	4	5	20
	C	Long Answer Type	200	4	12	48
Internal	Based on CT & Project					20
Total						**100**

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SUBJECT: M.Sc. ZOOLOGY
(2025-26)
SEMESTER - II

A. Lab Course-II Practical based on paper III & IV M.M- 100

III - Developmental Biology

1. Types of eggs based on quantity and distribution of yolk: sea urchin, insect, frog, Chick.
2. Comparative study of cleavage patterns in Frog and Amphioxus models.
3. Study of cell movement, shape and size during morphogenetic movement of Blastulation, Gastrulation in Frog, Amphioxus, Chick through models and charts.
4. Study of whole mounts and sections of developmental stages of frog through permanent slides: blastula, gastrula, neurula (Neural plate, Neural fold and Neural tube stages), tai-bud stage, tadpole (external and internal gill stages)
5. Study of whole mounts of developmental stages of chick through permanent Slides -18 hours, 24 hours, 33 hours, 48 hours, 72 hours and 96 hours of incubation.
6. Extra embryonic membranes of chick through models and charts.
7. In vivo study of chick embryo development by windowing and candling Methods. (Demonstration only)
8. Some videos to develop understanding on the process of development.
9. Group Discussion/Quiz/Seminar / Project related topics

IV - Basics of Computer and Biostatistics

- Exercise based on Microsoft word.
- Study of hardware & software.
- PPT Slide preparation using Microsoft Power Point.
- Data collection.
- Analyzing Data manually and through computer :Mean, Median, Mode, SD, SE ,Correlation and regression and its interpretation.
- Tabular &Graphical presentation of data manually and using excel
- Hypothsis testing by *t*-test, Chi -square test and ANOVA
- Group discussion/Quiz/Seminar presentation on related topics.
- Practical Recordor Lab assignment.

Scheme of Examination

		Time – 6 hours
9. Based on paper III	-	**35**
10. Based on paper IV	-	**35**
11. Viva	-	**10**
12. Sessional(Internal)	-	**20**

Total = 100 Marks

M.Sc. Zoology
(2025 – 26)
SEMESTER - III
Paper –I
POPULATION GENETICS AND EVOLUTION M.M. 80

Objectives: - This syllabus contains information about concept of evolution, genetics of speciation and molecular evolution. Students finds basic information how molecular evolution affected by genetic variation.

Unit I-

1. Concept of evolution and theories of evolution: Lamarkism, Darwinism,Neo-Darwinism,Modern Synthetic Theory.
2. Evidences of Evolution: anatomical,embryological,palaentological,physiological & Biochemical.

Unit II -

1. Hardy Wienberg law of genetic equilibrium.
2. Detailed account of destabilizing forces- 1.Natural selection 2. Mutation 3. Genetic Drift 4. Migration.
3. Calculation of Genotype & Allelic frequency.
4. Molecular clock.

Unit III – Molecular evolution

1. Pattern & mechanism of reproductive isolation.
2. Phylogenetic & biological concept of species.
3. Gene Evolution, Evolution of gene Families.
4. Genetic alternations and disorder.

UNIT IV- Evolution

5. Models of speciation (Allopatric, Sympatric and Parapatric
6. Major trends in the origin of higher categories.
1. Micro, Macro, Quantum and evolution
2. Phylogenic tree construction.
3. Phylogeny of horse,elephant,camel.
4. Phylogeny of Man.

Suggested Reading Materials:

1. Gene & Evolution: Jha A.P.
2. Evolution & Genetics: Merrel D.J.
3. The Genetics & Origin of Species: Dobzinansky,
4. Evolution: Dobzinansky, Ayala F.J., Stebbins G.L. 7 Valantine J.M
5. Species Evolution - The Role Of Chromosomal Change: King M.
6. Evolutionary Genetics: Amith J.M.
7. Evolutionary Biology: Futuyama D.J.
8. Evolution: Strikberger M.W.Jo

M.Sc. Zoology
(2025 – 26)
SEMESTER - III
Paper –II
ANIMAL BEHAVIOUR M.M. 80

Objectives: - This syllabus contains information about Ethology, communication, orientation and hormonal effect on behaviour. Students gain basic information of role of hormones in animal behaviour.

UNIT - I Ethology

1. Historical perspectives of ethology.
2. Behavioural patterns.
3. Biological rhythms
    - Types of rhythm
    - Biological Clock

Unit - II

1. Communication
    a. Auditory
    b. Visual
    c. Chemical
2. Learning and Memory
    a. Conditioning
    b. Habituation
    c. Reasoning
    d. Reproductive behaviour.

Unit III- Orientation

1. Echolocation in bats.
2. Bird Migration and Navigation.
3. Fish migration.
4. Neural and hormonal control of behaviour.

Unit IV – Hormonal effect on behavioural patterns.

1. Social behaviour.
2. Social organization in insect and primates.
3. Schooling in fishes and flocking in birds.
4. Homing, territoriality, dispersal.
5. Reproductive behaviour.

Suggested Reading Materials:

1. Animal Behavior: Mc Farland.
2. Animal Behavior: Arora M.P.
3. Animal Behavior: Reena Mathur.

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M.Sc. Zoology
(2025 – 26)
SEMESTER - III
Lab Course I based on paper I and II M.M- 100

I- POPULATION GENETICS AND EVOLUTION

1. Phylogenetic tree construction.
2. Practical based on phylogeny of Man and Horse.
3. Study of model based pedigree analysis.
4. Calculation of Body mass index.
5. Morphometric analysis.

II- PRACTICAL BASED ON ANIMAL BEHAVIOR

1. To study the Photo taxis response in Earthworm or grain/pulse pest.
2. To study the geotaxis behaviour of earthworm.
3. To study the food preferences and cleaning behaviour of housefly.
4. To study the food preference in tribolium or grain/pulse pests.
5. To study the web construction and habituation in spider.
6. Estimation of body temperature and pulse rate time scale.
7. Toxicological response of fish opercular and surfacing activity.

Scheme of Examination

Time – 6 hours

13. Based on paper III	-	**35**
14. Based on paper IV	-	**35**
15. Viva	-	**10**
16. Sessional(Internal)	-	**20**

Total = 100 Marks

M.Sc. Zoology
(2025 – 26)
SEMESTER - III
Paper –III

GAMETE AND DEVELOPMENTAL BIOLOGY MM- 80

Objectives: - This syllabus contains information about gamete biology. Students find basic information about embryological development in different vertebrates.

Unit I

1 Comparative account of different gonads in invertebrate and vertebrates.
2. Heterogamy in eukaryotes.
5. Leydig cells. - (a). Morphology (b) differentiation (c) functions and its regulation.

Unit II

1. Spermatogenesis in rodents and in invertebrates.
2. Oogensis and vitellogenesis (follicular growth differentiation, molecular and endocrinal aspects).
3. Fertilization - (pre and post fertilization events and biochemistry of fertilization).
6. Parthenogenesis.

Unit –III

1. Cleavage.
2. Fat map and cell lineage.
3. Gastrullation. (Frog & Chick)
4. Germinal layers and their fate. (Frog)
5. Extra Embryonic membrane.

Unit IV

1. Organogenesis - (Frog).
2. Metamorphosis.
3. Collection and Cryopreservation of gametes and embryos.
4. Transgenic animals.

Suggested Reading Materials:

1. Animal Gamete: Vishwanath.
2. Foundation of Embrology: Bradley M.
3. Fertilization in Animals: Brain Dale.
4. Developmental Biology: N.J.Berril.
5. Embryology of Vertebrates: Nelson.

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M.Sc. Zoology
(2025 – 26)
SEMESTER - III
Paper –IV
COMPARATIVE PHYSIOLOGY OF VERTEBRATES M.M. 80

Objectives: - This syllabus contains information about the origin of chordate, comparative account of blood circulation, Nervous system and sense organs. Students find fundamental knowledge of comparative physiology of various systems of vertebrates.

Unit I –Aims and scope of comparative physiology

1. General physiological function and principles.
2. Respiratory organs and respiratory pigments through different phylogenic groups.
3. Feeding mechanisms and regulation.
4. Comparative physiology of digestion.

Unit II-

1. Circulation of body fluids and their regulation comparative physiology of hearts.
2. Structure and physiology of blood.
3. Patterns of nitrogen excretion among different animal groups.
4. Thermoregulation.
    a. Homoeothermic animals.
    b. Poikilotherms.
    c. Hibernation.

Unit III- Receptor Physiology – A Comparative Study

1. Mechanoreceptor.
2. Photoreception.
3. Chemoreception.
4. Phonoreception.
5. Communication among animals.
    a. Bioluminescence.
    b. Pheromones.
    c. Audio signals.

Unit IV- Contractile elements, cells and tissues among different phylogenic groups

1. Muscles structure and function.
2. Nerve conduction.
3. Specialized organs electric organs and tissues.
4. Chromatophores and regulation of their function.

Suggested Reading Materials

1. Human physiology – C.C. Chatterjee.
2. Physiology of human body – Guyton.
3. Comparative physiology- Hoor
4. Harper Biochemistry – David Motrin.
5. Principles of Biochemistry.

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M.Sc. Zoology
(2025 – 26)
SEMESTER - III

Lab course –II based on paper III & IV M.M- 100

III -GAMETE AND DEVELOPMENTAL BIOLOGY

1. Study of slides of development of frog.
2. Study of development of Hens egg by cover window method, staining and mounting of blastodisc.
3. Study of caudal regeneration in Teleost.(Meal time effect)
4. Study of embryological slides: spermatogenesis, Oogensis, histology of gonads.
5. Study of effect of thyroid hormone on metamorphosis of tadpole.
6. Preparation of whole mount of embryo and larva. (Method only)
7. Alizarin preparation of embryo. (Method only)
8. Morpho histology of gonads of frog, lizards, chicks and mouse.
9. Other exercise to theory paper.

IV -COMPARATIVE PHYSIOLOGY OF VERTEBRATES

1. Various slides of chick embryology (whole mount and T.S.).
2. Physiological experiment
    a. Detection salivary amylase.
    b. Comparative study of histology of lungs kidney gonads in vertebrates
    c. Comparative study of blood of vertebrate, blood cell, blood albumin, sugar, cholesterol).
    d. Urine analysis.
2. Hematological Experiments - Own blood.

Scheme of Examination

		Time – 6 hours
17. Based on paper III	-	**35**
18. Based on paper IV	-	**35**
19. Viva	-	**10**
20. Sessional(Internal)	-	**20**

Total = 100 Marks

M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Elective A: Biochemistry
Paper –I (Compulsory)
Biochemistry M.M. 80

Objectives: - This syllabus contains information of basic Biochemistry of organisms. Students find detail information of biomolecules, vitamins, enzymes and cellular metabolism of organisms.

Unit I –

1. Amino acids-structure and classification
    - Structure of proteins.
    - Biosynthesis of amino acids.
    - Catabolism's of proteins.

Unit II-

1. Structure & classification of carbohydrates.
2. Metabolisms of carbohydrates.
3. Structure & classification of lipid.
4. Biosynthesis of Fatty acid.

Unit III - Vitamins

1. Water and fat soluble vitamins.
2. Chemistry, occurrence and Physiological role.
3. Enzymes classification and nomenclature.
4. Mechanism of enzyme action.
5. Kinetics of enzymes.
6. Enzyme immobilization.

Unit IV-

1. Vitamins- structure and classification.
2. Metabolism of nucleic acid.
3. Hormonal regulation of carbohydrate metabolism.
4. Hormonal regulation of protein metabolism.
5. Hormonal regulation of lipid metabolism.

Suggested Reading Materials:

1. Hand book of Biochemistry -MA. SIDHIQI 8th edition.
2. Fundamentals of Biochemistry- J.L. Jain 2nd edition.
3. Cell physiology and biochemistry- William D. McELROY 3rd edition.
4. Introducing biochemistry - E.J. WOOD,W.R. PICKERING 1st edition.
5. Practical clinical biochemistry - HAROLD VARLEY 4th edition.

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M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Elective B: Limnology
Paper –II (Compulsory)
Limnology **M.M. 80**

Objectives: - This syllabus contains information of limmunological study of fresh water. Students find detail information of water quality management detailed study of plankton. How water quality affected by sewage water study of different physic-chemical parameters.

Unit I –

1. Characteristics of water.
2. Lotic ecosystem.
3. Rivers and lake-forms and origin of lake.
4. Lentic ecosystem.

Unit II-

1. Pond ecosystem and communities.
2. Phytoplankton of fresh water.
3. Zooplankton of fresh water.
4. Estuaries.

Unit III -Physical condition of water

1. Light (light as a limiting factors, penetration and thermal radiation).
2. Heat (thermal stratification, flow of heat,).
3. Water (properties of water, hydrological cycle, global water balance).
4. Water movement (flow of water, motion in epilimnion, motion in thermocline, motion in hypolimnion).

Unit IV- Chemical component of fresh water

1. Oxygen (oxygen as a limiting factors, measurement in waters, pollution monitoring and productivity measurement).
2. Carbon complex (carbon as a limiting factor, productivity measurement, seasonal variations, utilization).
3. Nitrogen (cycle, forms of N_2 in lakes, seasonal distribution, nitrogen fixation and Di-nitrification).
4. Phosphorus (distribution, cycle, recycling).
5. Iron, silica and sulphur (cycle, bacterial transformation).

Suggested Reading Material

1. Fundamental of limnology. Arvind kumar ,APH Publication,2005
2. T G, Wetze Limnology, Third Edition; Lake and River Ecosystem.
3. Fresh water Ecology, Second Edition; Concept and Environmental Application of Limnology (Aquatic Ecology), Walter K. Dodds, Matt R Whiles.

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M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Paper –I
Elective A: Biochemistry & Limnology
LAB COURSE I BASED ON PAPER I& II **MM 100**

I- Biochemistry

1. Estimation of antioxidant enzymes.
2. Estimation of amylase, analitative of amylase.
3. Analitative study of protein.
4. Analitative study of CBH.
5. Estimation of protein by Lowery method.
6. Estimation of Oil in seeds.
7. Estimation of Carbohydrates by Anthrone reagent.
8. Other exercise related to theory paper.

II- Limnology

1. Determination of Heavy metal from water & soil, viz As, Fluoride, Cd, Cr, Fe.
2. Determination of transparency from different water body.
3. Determination different Physico-Chemical analysis of pond water (Temperature, Turbidity, pH, Conductivity, Total Hardness, Alkalinity, DO, COD, BOD etc.).

Scheme of Examination

		Time – 6 hours
21. Based on paper III	-	**35**
22. Based on paper IV	-	**35**
23. Viva	-	**10**
24. Sessional(Internal)	-	**20**

Total = 100 Marks

M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Elective A: ICHTHYOLOGY
Paper –III (Optional Paper)

M.M. 80

Objectives: - This syllabus contains study of general characters, classification, anatomy and phylogeny of fishes and fish physiology.

UNIT – I - General Characteristic & Classification of Fish

1. Placoderm.
2. Chondrichthyes.
3. Osteichthyes.
4. Holocephali.
5. Dipnoi.

UNIT – II - Anatomy:-

1. Integuments (Skins and its derivatives).
2. Medium paired Fins of Fishes.
3. Food and Alimentary canal, Modification of Alimentary canal.
4. Blood Vascular System.
5. Respiration- Respiratory Organs and Mechanism, Accessory respiratory organ.

UNIT-III

1. Swim bladder- structure & functions.
2. Nervous system.
3. Sense organs (eye, membranous labyrinth, lateral line system).
4. Endocrine glands in fishes.
5. Luminous organ in fishes.

UNIT-IV

1. Excretion (structure of kidney, histology).
2. Osmoregulation – in marine and fresh water fishes.
3. Reproduction and development.
4. Hatching and post embryonic development.
5. Parental care in fishes.

Suggested reading material:

1. An introduction to Fishes S.S. Khanna.
2. Fish and Fisheries R.P.Parihar.
3. Fisheries and Aquaculture R.C. Gupta and P.K. Gupta-
4. Biology of Fishes - Jingran.

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M.Sc. Zoology
(2022 – 2023)
SEMESTER - IV
Elective A: Pisiculture and Fishery Economics
Paper –IV (Optional Paper)

MM: 80

Objectives: - This syllabus contains study of Pisiculture, World fisheries, Cultivable fisheries and Economic importance of fishes.

UNIT –I

1. Physico-chemical and biological characteristics for Fish Farming.
2. Fish form (type of ponds, construction, maintenance and Management).
3. Aquatic weeds and their control.
4. Collection of fish seed from natural resources and their transportation.
5. Fish breeding (Bundh, Induced).

UNIT-II

1. The EEZ concept and its implementation.
2. Coastal fisheries of India.
3. Riverine fisheries.
4. Estuarine fisheries.
5. Cold water fisheries.

UNIT –III -

1. Composite fish culture.
2. Air breathing fish culture.
3. Paddy-cum fish culture.
4. Sewage-fed fisheries.
5. Open water stocking and ranching.

UNIT IV

1. Fish harvesting (Conventional & unconventional method, preservation & processing).
2. Fish Marketing.
3. Fish disease and their control.
4. Economic importance and by production of fishes.
5. Role of fisheries in rural development.

Suggested reading material:

1. Source book for the inland fishery resources of Africa. J.P.Vandan, Bossche, G.M.Bernacsek.
2. Capture based Aquaculture F.Ottolenglin, F Silvestri..
3. Technologycal trends in capture fisheries. J.W.Waled, Marsen 2001.
4. Gloom and doom the future of marine capture fisheries.S.M.Garcia and Grainger.
5. Aquaculture and fisheries. Wageningen,U.R.
6. Fish forming Aquaculture Commerrical fishing WWW.ftal.com.
7. Aquaculture fisheries and fish Science Wiley.

M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Elective A

LAB COURSE II – BASED ON PAPER III & IV MM 100

III- ICHTHYOLOGY

1. Study of museum specimens of the concerned groups.
2. Study of histological permanent slides.
3. Osteology of fish.
4. Cranial nerves of teleost fishes: *Wallago, Mystus, Labeo* and other fishes by using alternate methods.
5. Study of Accessory of respiratory organ in fishes using alternate methods.
6. Other exercise related to theory paper.

IV- Pisiculture and Fishery Economics

1. Identification of fresh water Fishes with particular reference of C.G.
2. To determine the age of fish by scale/otolith reading method.
3. Pigmentary behavior of fish
4. Quantitative zooplankton analysis.
5. Nutrient analysis of water.
6. Microtomy of fish material.

Scheme of Examination

		Time – 6 hours
25. Based on paper III	-	**35**
26. Based on paper IV	-	**35**
27. Viva	-	**10**
28. Sessional(Internal)	-	**20**

Total = 100 Marks

M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Elective A: Biochemistry
Paper –I (Compulsory)
Biochemistry **M.M. 80**

Objectives: - This syllabus contains information of basic Biochemistry of organisms. Students find detail information of biomolecules, vitamins, enzymes and cellular metabolism of organisms.

Unit I –

5. Amino acids-structure and classification
    - Structure of proteins.
    - Biosynthesis of amino acids.
    - Catabolism's of proteins.

Unit II-

5. Structure & classification of carbohydrates.
6. Metabolisms of carbohydrates.
7. Structure & classification of lipid.
8. Biosynthesis of Fatty acid.

Unit III - Vitamins

6. Water and fat soluble vitamins.
7. Chemistry, occurrence and Physiological role.
8. Enzymes classification and nomenclature.
9. Mechanism of enzyme action.
10. Kinetics of enzymes.
11. Enzyme immobilization.

Unit IV-

12. Vitamins- structure and classification.
13. Metabolism of nucleic acid.
14. Hormonal regulation of carbohydrate metabolism.
15. Hormonal regulation of protein metabolism.
16. Hormonal regulation of lipid metabolism.

Suggested Reading Materials:

1. Hand book of Biochemistry -MA. SIDHIQI 8th edition.
2. Fundamentals of Biochemistry- J.L. Jain 2nd edition.
3. Cell physiology and biochemistry- William D. McELROY 3rd edition.
4. Introducing biochemistry - E.J. WOOD,W.R. PICKERING 1st edition.
5. Practical clinical biochemistry - HAROLD VARLEY 4th edition.

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M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Elective A: Neurophysiology
Paper –II (Compulsory)
Neurophysiology **M.M. 80**

Objectives: - This syllabus contains information of basics of nervous system, nerve conduction, brain, spinal cord and Electro encephalography. Students find detail information of Neurophysiology.

Unit I –

1. Histogenesis and types of nerve cells.
2. Histological Structure of nerves system.
3. Physiological properties of nerve fiber.
4. Synapse and synaptic transmission.

Unit II-

1. Spinal cord – arrangement of grey and white matter.
2. The spinal nerves.
3. The tract – ascending tract.
4. The tract – descending tract.

Unit III -

1. Cerebrum.
2. Brain stem- mid brain, pons variolli, medulla oblonga.
3. Cerebellum.
4. Thalamus.

Unit IV-

1. Autonomic nervous system; sympathetic and parasympathetic nervous system with Special comparison to hormonal mechanism of transmission through autonomic nervous system.
2. Reflex action; verities, characteristics, unconditional reflex, electrophysiology of Spinal reflexes.
3. Sensation.
4. Electro encephalography and its physiological basis.

Suggested readings:

- The Brain: Or Nervous system by Seymour Simon.
- Mass Action in the Nervous system by Walter J. Freeman.
- Human Anatomy and Physiology with Interactive Physiology10-
- System Suite,8th Edition by Elaine N. Marieb and Katja N. Hoehn(Jan10,20210)
- Neuroanatomy by H.G. Snell.
- Cranial Neurophysiology – Guide for Authors – Elsevier.

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M.Sc. Zoology
(2025 – 26)
SEMESTER – IV
Paper –I Elective A: Biochemistry & Neurophysiology

LAB COURSE I BASED ON PAPER I& II MM 100

I- Biochemistry

1. Estimation of antioxidant enzymes.
2. Estimation of amylase, analitative of amylase
3. Analitative study of protein.
4. Analitative study of CBH.
5. Estimation of protein by Lowery method.
6. Estimation of Oil in seeds.
7. Estimation of Carbohydrates by Anthrone reagent
8. Other exercise related to theory paper.

II- Neurophysiology

1. Study of slides of nervous system.
2. Neck nerve of /squirrel by using alternate methods like clay modeling.
3. Study of Brain through Model.
4. Study of Cranial nerve of Bird, Amphibian, Reptile and Mammals by using alternate methods like clay modeling.
5. Other exercise related to theory paper.

Scheme of Examination

Time – 6 hours

29. Based on paper III	-	**35**
30. Based on paper IV	-	**35**
31. Viva	-	**10**
32. Sessional(Internal)	-	**20**

Total = 100 Marks

M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Elective B: Entomology
Paper –III (Optional Paper)
Entomology **M.M 80**

Objectives: - This syllabus contains study of general characters, classification,phylogeny of insects, insect biology and anatomy.

Unit-I

- Insect head types and modification as per their habit and habitat.
- Modification of mouth parts and feeding behavior.
- structure, types and function of antennae.
- Hypothetical wings venation.
- Structure of cuticle and pigment.

Unit-II

- Sclerotisation and taining of the cuticle.
- Structure of alimentary canal and physiology of digestion.
- Malpighian tubes- anatomical organization, transport mechanism.
- Structure of circulatory system.
- Cellular element in haemolymph.

Unit- III

- Structure of compound eye and physiology of vision.
- Sound production in insect.
- Structure and function of endocrine gland.
- Pheromones.

Unit – IV

- Embryonic membranous up to the formation of blastoderm.
- Metamorphosis.
- Insecticide effects on CNS.
- Important pest of soybean, concept of pest management suggested.

Suggested reading materials:

1. Insect structure and function -R.F.Chapman.
2. General and applied entomology.- Little.
3. Insect physiology- Wigglesworth.
4. Insect morphology- Matcalf and flint

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M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Elective B: Applied Entomology
Paper –IV (Optional Paper)
Applied Entomology **M.M.80**

Objectives: - This syllabus contains study of morphology and insect anatomy.

UNIT –I

- Classification according to Imms.
- Classification of aptyrogota up to families.
- Classification of insect orders - orthoptera, hemiptera, diptera, hymenoptera. Lepidoptera, coleoptera.
- Collection and preservation of insects.

UNIT - II

- Insect pest management strategies and tools.
- Biological control, genetic control, chemical control.
- Pests of cotton, sugarcane, paddy, stored food grains.
- Pests of citrus fruits and mango.
- Pests of pulses.
- House hold insect pest.

UNIT-III-

- Insects in relation to forensic science.
- Insect migration, population, fluctuation and factors.
- Insect of medical and veterinary importance.
- Ecological factors affecting the population and development of insects.

UNIIT - IV

- Mulberry and non mulberry sericulture.
- Apiculture.
- Lac culture.
- Insects as human food for future.

Suggested Reading Material

1. An introduction to the study of insects by borer and Delong.
2. Entomology by Imms.
3. General and Applied Entomology by Nayer.
4. Entomology Text Book by Jack De Angelis.
5. applied agricultural entomology by dr. lalit kumar jha.

M.Sc. Zoology
(2025 – 26)
SEMESTER - IV
Elective B: Entomology and Applied Entomology
Lab Course - (Based on paper III & IV) M M 100

III-Entomology

1. Anatomy of common grasshopper, cockroach, honeybee, wasp, and belestoma (giant water bug) by using alternate method like clay modelling.
2. Dissection by using alternate method like clay modelling.
   - Sting apparatus of honeybee and wasp.
   - Tympanal organs of grasshopper.
   - Testes of cockroach.
   - Aristae of housefly.
   - Different types of mouthparts of insect.
   - Different types of wings and antennae of insects.
   - Tentorium of grasshopper.
3. Identification and comment on insect of different orders and families.
4. Identification with the help of keys of common insect from different orders and families.
5. Other exercise related to theory paper.

IV-Applied Entomology

1. Insect collection and preservation for systematics studies
2. Identification of insect of different insect up to orders.
3. Identification of insect's up to families of economically important insects up to orders.
4. Identification of insects up to species: Mosquitoes, honeybee, stored grain beetles, aquatic insects, important crop and household pests.
5. Analysis of honey and its quality control.
6. Field studies of insects to understand their habit, habitat environment impact, beneficial and harmful activities etc.
7. Study of beneficial insects, benefits derived from them and useful products.
8. Study of destructive insects, damage caused by them and damaged products.
9. Study of insecticidal formulations and insect control appliances.
10. Experiments on insect control like LC-50,/LD-50,knock down and recovery effect, repellency/antifeedance tests, percentage damage tests for leaf eating insects and stored grain .
11. Other exercise related to theory paper.

Scheme of Examination

		Time – 6 hours
33. Based on paper III	-	**35**
34. Based on paper IV	-	**35**
35. Viva	-	**10**
36. Sessional(Internal)	-	**20**

Total = 100 Marks
